

III. The Claims Define Patentable Subject Matter

The Office Action rejects claims 1 and 3-10 under 35 U.S.C. §102(b) over JP08093594 (the 594 patent); claims 2, 11 and 15-30 under 35 U.S.C. §103(a) over the 594 patent in view of JP07241548 (the 548 patent); and claims 12-14 and 30 under 35 U.S.C. §103(a) over the 594 patent in view of JP04326933 (the 933 patent). These rejections are respectfully traversed.

The 594 patent does not disclose or suggest a method of manufacturing a semiconductor device including, inter alia, applying a pressure to a semiconductor assembly by at least one support pin so as to cause a stress in the lead frame, sealing the semiconductor assembly with a resin injected into the cavity from a resin injection port of the mold, and pulling the support pin from the cavity into the mold before the resin is cured to release the semiconductor from the pressure applied by the support pin, as recited in claim 1. Further, the 933 patent does not disclose or suggest a method of manufacturing a semiconductor device including, inter alia, applying a pressure to a heat radiator by at least one support pin so as to cause a stress in the lead frame, injecting a resin into the cavity from a resin injection port, and pulling the support pin from the cavity into the mold before the resin is cured to release the heat radiator from the pressure applied by the support pin, as recited in claim 12. Further, the 594 patent, whether alone or in combination with the 548 patent, does not disclose or suggest a molding device for a semiconductor device including, inter alia, an actuator which moves the support pin in a direction of the axis of the support pin such that during injecting the resin into the cavity the support pin applied a pressure to the semiconductor assembly so as to cause a stress in the lead frame and such that the support pin releases the semiconductor assembly from the pressure applied by the support pin after the resin is injected before the resin is cured, as recited in claim 15.

In accordance with the claimed invention, a stress is caused in the lead frame by applying a pressure to a member positioned in the cavity by at least one support pin. However, the stress caused by the pressure is relieved before the resin is cured because the support pin releases the member positioned in the cavity from the pressure before the resin is cured.

In contrast, the applied references do not disclose the above feature. For example, the 549 patent and the 548 patent do not disclose a pressure being applied so as to cause a stress because both sides of the substrate are pressed. The 933 patent discloses that the support pin 17 is pulled out, however the removal of the support pin 17 does not relieve a stress because the support pin 17 is pulled out after the resin 14 is cured. See Fig. 1C of the 933 patent.

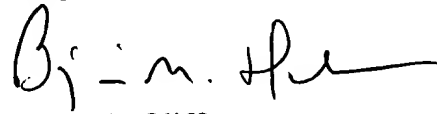
For at least these reasons, it is respectfully submitted that claims 1, 12 and 15 are patentable over the applied references. The dependent claims are likewise patentable over the applied references for at least the reasons discussed as well as for the additional features they recite. Applicant respectfully requests that the rejections under 35 U.S.C. §102 and §103 be withdrawn.

IV. Conclusion

In view of the foregoing, Applicant respectfully submits that this application is in condition for allowance. Favorable consideration and prompt allowance are earnestly solicited.

Should the Examiner believe anything further is desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact Applicant's undersigned representative at the telephone number listed below.

Respectfully submitted,



James A. Oliff
Registration No. 27,075

Benjamin M. Halpern
Registration No. 46,494

JAO:BMH/gpn

Attachments:

Appendix
Request for Approval of Drawing Corrections
Petition for Extension of Time

Date: July 15, 2002

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

<p>DEPOSIT ACCOUNT USE AUTHORIZATION Please grant any extension necessary for entry; Charge any fee due to our Deposit Account No. 15-0461</p>
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APPENDIX

Changes to Specification:

Page 15, line 12 through page 16, line 1:

Fig 8 shows a fifth embodiment of the present invention. In this embodiment, a semiconductor device having a heat sink is manufactured. A heat radiator 70 is disposed in the cavity 38 of the lower mold ~~38-36~~ and supported by the support pin 42 as shown by the broken line in Fig. 8. A recess 72 is formed in the center of the bottom of the heat radiator 70 for preventing mispositioning. The upper end of the support pin 42 is secured in the recess 72 to support the heat radiator 70. The semiconductor assembly 10 is placed on the upper side of the heat radiator 70 supported by the support pin 42. After the semiconductor assembly 10 is disposed, the upper mold 34 is closed and the resin is injected into the cavity 38. After the resin is injected, the support pin 42 is pulled into the lower mold 36 at an appropriate time as shown by the solid line in Fig. 8, and the resin is cured as described.

Changes to Claims:

Claims 10, 19, 23 and 28 are canceled.

The following is a marked-up version of the amended claims:

1. (Amended) A method of manufacturing a semiconductor device comprising: a step of
_____ placing a semiconductor assembly in which a semiconductor chip is secured to a die pad of a lead frame in a cavity of a mold; ~~and~~
_____ applying a pressure to the semiconductor assembly by at least one support pin so as to cause a stress in the lead frame;
_____ sealing the semiconductor assembly with a resin injected into the cavity from a resin injection port of the mold;

~~wherein at least one support pin positioned substantially on the axis of a resin injection port of the mold is caused to come in contact with the semiconductor assembly; and~~
~~pulling the support pin from the cavity into the mold before the resin is cured to release the semiconductor assembly from the pressure applied by the support pin~~
~~wherein the resin injected into the cavity from the resin injection port is cured after the support pin has been pulled into the mold.~~

5. (Twice Amended) The method of manufacturing a semiconductor device as defined in claim 1,

wherein the semiconductor assembly is pushed by the support pin in a direction away from the previous position of the contact portion of ~~the~~ a support pin.

11. (Amended) The method of manufacturing a semiconductor device as defined in claim 1,

wherein ~~a pair of~~ the support pins ~~pin~~ is caused to come in contact with ~~the~~ a suspension leads ~~lead~~ that ~~connect~~ connects the die pad to a frame of the lead frame.

12. (Amended) A method of manufacturing a semiconductor device comprising the steps of:

supporting a heat radiator placed in a cavity of a mold with at least one support pin ~~provided substantially on the axis of a resin injection port;~~

placing a die pad of a lead frame to which a semiconductor chip is secured on the heat radiator;

~~and closing the mold; and~~

applying a pressure to the heat radiator by at least one support pin so as to cause a stress in the lead frame;

~~curing~~ injecting a resin ~~injected~~ into the cavity from ~~the~~ a resin injection port ~~after pulling the support pin into the mold; and~~

pulling the support pin from the cavity into the mold before the resin is cured to release the heat radiator from the pressure applied by the support pin.

15. (Amended) A molding device for a semiconductor device comprising:

a mold which is capable of being opened or closed and is provided with a cavity for placing a semiconductor assembly which comprises a semiconductor chip secured to a die pad of a lead frame;

a resin injection port provided to the mold for injecting a resin into the cavity;

at least one support pin provided in the cavity ~~substantially on the axis of the resin injection port~~ such that the support pin is able to enter into or be pulled out of the cavity to come in contact with the semiconductor assembly in the cavity; and

an actuator which moves the support pin in a direction of the axis of the support pin such that during injecting the resin into the cavity the support pin applies a pressure to the semiconductor assembly so as to cause a stress in the lead frame and such that the support pin releases the semiconductor assembly from the pressure applied by the support pin after the resin is injected before the resin is cured.

24. (Amended) The molding device for a semiconductor device as defined in claim 15,

wherein ~~a pair of the support pins~~ pin is provided substantially on the axis of the resin injection port; and

wherein the support ~~pins~~ pin ~~are~~ is placed at ~~a positions~~ position corresponding to ~~a suspension leads~~ lead which ~~connect~~ connects the die pad ~~of the semiconductor assembly~~ to a frame of the lead frame.